

REVISED
BORIC ACID LISTING BACKGROUND DOCUMENT
FOR THE INORGANIC CHEMICAL
LISTING DETERMINATION

This Document Contains No Confidential Business Information

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TABLE OF CONTENTS

1.	SECTOR OVERVIEW	1
1.1	SECTOR DEFINITION, FACILITY NAMES AND LOCATIONS	1
1.2	PRODUCTS, PRODUCT USAGE AND MARKETS	1
1.3	PRODUCTION CAPACITY	2
2.	IMC CHEMICALS INC.	4
2.1	DESCRIPTION OF MANUFACTURING PROCESS	4
2.2	WASTE GENERATION AND MANAGEMENT	8
2.2.1	Bevill Wastes	8
2.2.2	In-process Recycling	9
2.2.3	Fuel Oil from the Crud Treatment Facility	9
2.2.4	Miscellaneous Wastewaters	9
2.2.5	Organics from the Trona Skimmer	11
2.2.6	Sludges from Containment Areas	12
2.2.7	Spent Activated Carbon	13
3.	U.S. BORAX	13
3.1	DESCRIPTION OF MANUFACTURING PROCESS	13
3.2	WASTE GENERATION AND MANAGEMENT	16
3.2.1	Bevill Claims	16
3.2.2	In-process Recycling	16
3.2.3	Tailings	16
3.2.4	Gangue	18
3.2.5	Spent Filters	20
Appendix A: Summary of Waste Generation and Management		
Appendix B: IMC Chemicals Inc. Trona Carbon Regeneration Furnace Emissions Data		
Appendix C: Analytical Data Report for U.S. Borax Tailing Ponds		
Appendix D: Analytical Data Report for U.S. Borax Gangue		
Appendix E: EPA Memos on the Regulatory Status of Wastes from Searles Lake Operations		
Appendix F: List of Changes to Background document		

LIST OF TABLES

Table 1.1 Boric Acid Producers	1
Table 2.1 Volume and Characterization for Miscellaneous Wastewaters	10
Table 3.1 U.S. Borax Tailings Waste Characterization Data	17
Table 3.2 U.S. Borax Boric Acid Gangue Waste Characterization Data	18
Table 3.3 Comparison of Waste Concentration in U.S. Borax Gangue to Health-Based Ingestion Levels	20

LIST OF FIGURES

Figure 1.1 Geographical Distribution of Boric Acid Producers	3
Figure 2.1 IMC Chemical Process Flow Diagram for Boric Acid	6
Figure 3.1 U.S. Borax Process Flow Diagram for Boric Acid	15

1. SECTOR OVERVIEW

1.1 SECTOR DEFINITION, FACILITY NAMES AND LOCATIONS

Boric acid is currently produced in the United States by two manufacturers. **Table 1.1** presents the names and locations of these manufacturers.¹ **Figure 1.1** shows their geographical location on a U.S. map. Both facilities are located in the Mojave Desert in California, one of the few areas where borate minerals can be mined in the U.S. The numbers on the map correspond to the facility numbers in Table 1.1.

Table 1.1 Boric Acid Producers

Facility Number	Facility Name	Facility Location
1	IMC Chemicals Inc.	Trona, CA
2	U.S. Borax, Inc.	Boron, CA

The two boric acid manufacturers utilize completely different processes and thus generate unique wastes. Chapter 2 describes IMC Chemicals, Inc.; Chapter 3 describes U.S. Borax, Inc.

1.2 PRODUCTS, PRODUCT USAGE AND MARKETS

The chemical formula for boric acid, also known as boracic acid, borofax, hydrogen orthoborate, and orthoboric acid, is H_3BO_3 . It is generally a colorless, crystalline powder and has a molecular weight of 61.83 gram (g)/mol. Boric acid has a melting point of 171 degrees Celsius (/C) and a boiling point of 300 /C, at which point it decomposes.²

Uses for boric acid are extremely varied. Boric acid can be used to produce several boron chemicals, such as synthetic inorganic borate salts, fluoroborates, boron phosphate, boron trihalides, borate esters, and boron carbide. Boric acid is used as a preservative in natural lumber, rubber, leather, and starch products and as a component of fluxes for welding and brazing. While boric acid can be used as an antiseptic for humans in mouthwashes, hair rinse, talcum powder, eyewashes, and ointments, it is poisonous to some insects and can therefore be used in pest control formulations as well.

Because boric acid is a source of boron oxide (B_2O_3), it has applications in fused products such as textile fiber glass, optical and sealing glass, heat-resistant glass, ceramic glazes, and porcelain enamels.

Inorganic boron compounds, such as boric acid, can also be used as flame retardants. Boric acid, alone or with sodium borates is most effective as a flame retardant in wood products, cellulose

¹ Environmental Protection Agency, RCRA 3007, Survey of Inorganic Chemicals Industry

² *Handbook of Chemistry and Physics*, 45th edition, the Chemical Rubber Co, 1964.

insulation, and cotton batting used in mattresses.

The nuclear power industry has made use of boric acid's ^{10}B isotope, which is a good absorber of thermal neutrons. Boric acid can be used, for example, in the cooling water used in high pressure water reactors.³

1.3 PRODUCTION CAPACITY

The production capacity for borates (boron minerals and refined borate chemicals on a boron oxide (B_2O_3) basis) as of September 1997 was approximately 825,000 short tons per year. The principal chemicals produced from borates includes boric acid, borax pentahydrate, anhydrous borax, and borax decahydrate.⁴

³Kirk-Othmer Encyclopedia of Chemical Technology. Vol.4, "Boron Compounds", John Wiley & Sons, p. 76

⁴<http://www.chemexpo.com/news/PROFILE970905.cfm>

Figure 1.1 Geographical Distribution of Boric Acid Producers¹



¹ See **Table 1.1** for facility name and location.

2. IMC CHEMICALS INC.

IMC Chemicals Inc. recovers borate from brines pumped from beneath Searles Dry Lake, California. They extract the highly mineralized brine and use a liquid-liquid extraction process to remove the borates from the brine.

2.1 DESCRIPTION OF MANUFACTURING PROCESS

IMCC's boric acid production can be broken up into two sequential processes: the liquid-liquid extraction (LLX) process and the crystallization and evaporation process. **Figure 2.1** shows the IMC Chemicals Inc. process flow diagram for the production of boric acid utilizing the brine recovery process.

LLX Process

1. To begin the LLX process, highly mineralized brine from beneath Searles Dry Lake is mixed with an organic extractant (chelating agent) in a kerosene solution that bonds with the boron and some of the potassium and sodium compounds in the brine producing a loaded extractant. This step, called the loading section by the facility, generates partially depleted brine (Bevill-exempt) which is managed onsite prior to being returned to Searles Dry Lake via percolation ponds.
2. The loaded extractant then is sent through strippers where it is mixed with dilute sulfuric acid to strip the boron, potassium, and sodium from the extractant forming a boric acid, sodium sulfate, and potassium sulfate solution (referred to as strip solution). This step produces a stripped extractant, referred to as barren extractant, which is stored in a barren extraction tank and reused in the loading section. Some of the barren extractant is periodically bled off to the "crud" treatment facility to control accumulation of non-active compounds in the extractant.
3. The strip solution enters the final strip solution (FSS) settler where the separation of mineral rich liquor and aqueous/organic emulsion (crud) occurs. At this point in the process, the FSS liquor is sent to the crystallization and evaporation process. During settling step, the crud separates from the mineral rich liquor and is sent to the crud treatment facility.

Crystallization and Evaporation Process

1. The FSS liquor passes through two (intermediate and 303) tanks en route to the crystallization and evaporation process. The tanks provide surge capacity. Carryover crud separates from the liquor in the tanks and is sent to the crud treatment facility. If tank levels get too high, excess liquor is discharged from the bottom of the tanks to the "Trona skimmer."
2. The FSS liquor is fed to a carbon column to remove any remaining organic substances. The carbon is washed daily, generating a wash water. On a weekly basis, the carbon from the carbon column is cleaned in the carbon cleaning system (washing and regeneration in a furnace). This generates wash waters and regenerated carbon.
3. From the carbon column, the FSS liquor is sent to the second effect crystallizer evaporator producing a slurry of boric acid crystals suspended in liquor. The evaporated water vapor is condensed and used to supplement the supply of cooling water to the cooling tower. The slurry

settles, with the solids going to the #2 centrifuge and the liquid going through the first effect crystallizer evaporator.

4. In the #2 centrifuge, additional liquid is removed and is sent to the first effect crystallizer evaporator to separate out the sodium sulfate and potassium sulfate. The solid stream from the first effect crystallizer evaporator is sent to a settler where the liquid containing the boric acid is returned to the second effect crystallizer evaporator. The solids are settled and centrifuged with the liquid returned to the second effect crystallizer evaporator to remove additional boric acid. The solids are a mixed sulfates slurry waste stream that is dissolved in water and sent to the Trona skimmer.

5. The solids exiting the #2 centrifuge, i.e., boric acid crystals, are washed with water and sent through a rotary dryer. After drying, the crystals are cooled, screened and stored prior to packaging for customers. Air generated from the rotary dryer is sent through a scrubber. The scrubber water is sent to the Trona skimmer.

Figure 2.1 IMC Chemical Process Flow Diagram for Boric Acid

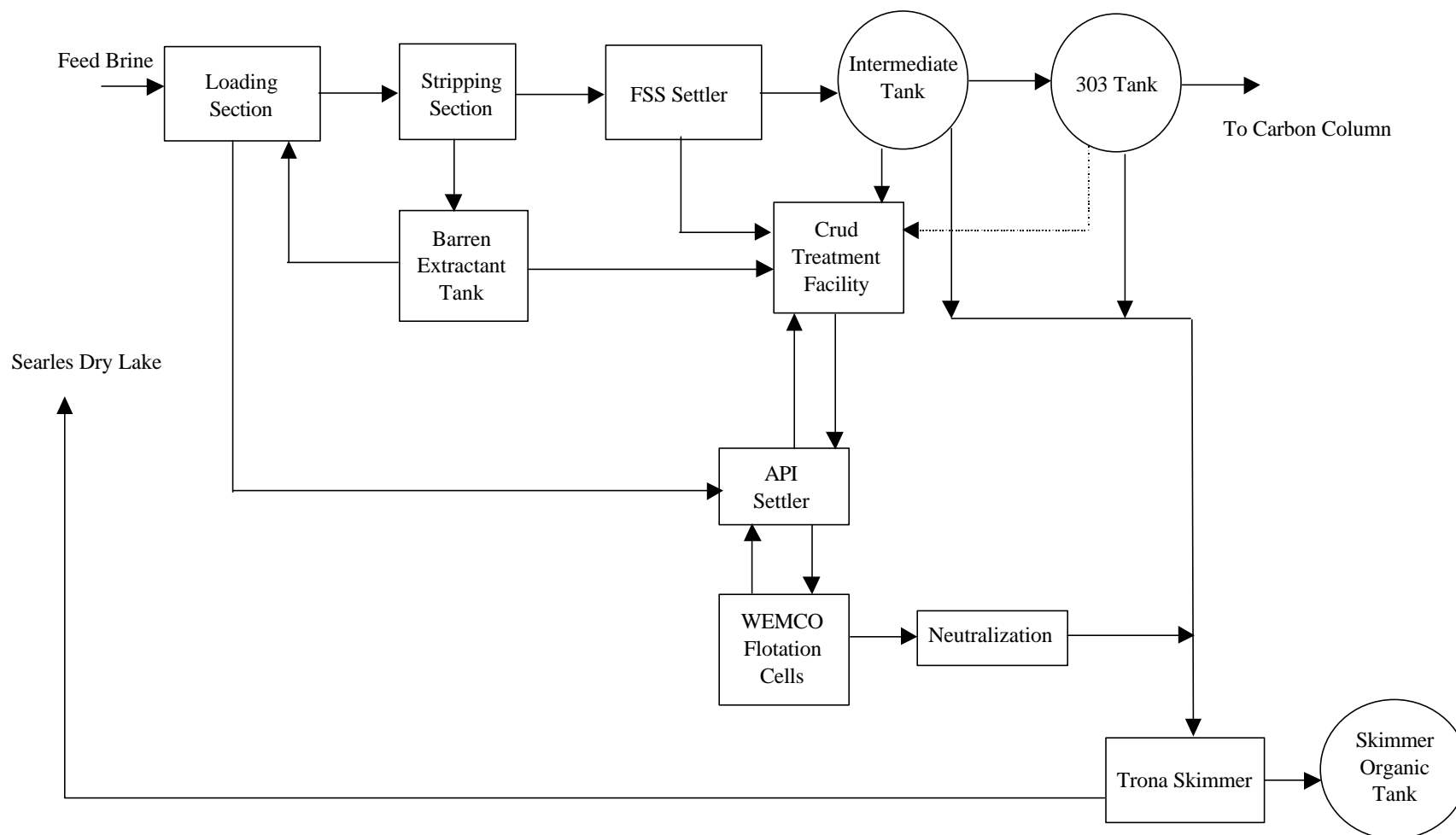
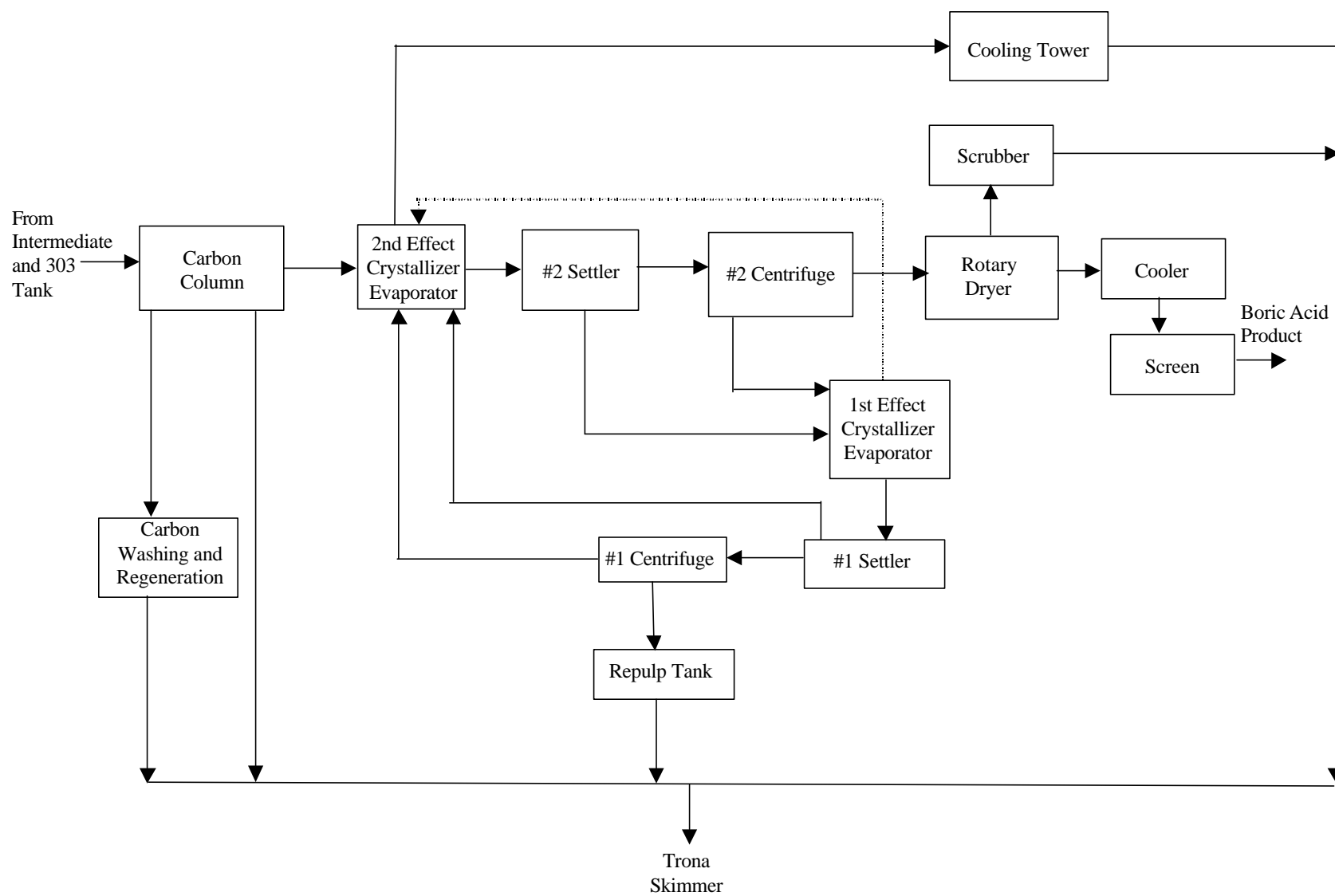


Figure 2.1 IMC Chemical Process Flow Diagram for Boric Acid (continued)



2.2 WASTE GENERATION AND MANAGEMENT

Appendix A presents a complete summary of the wastestreams generated and their management by facility. The following sections present a detailed discussion of the wastestreams generated at IMC Chemical Inc. including each wastestream's generation, management, and characterization.

2.2.1 Bevill Wastes

IMC Chemical produces a Bevill-exempt beneficiation waste as defined in 40 CFR §261.4(b)(7), which is outside the scope of the consent decree. This is the partially depleted brine from the loading section of the brine recovery process. In 1998, 4,600,000 MT (RIN28) were generated. This Bevill-exempt waste is commingled with wastes which do not qualify for the Bevill exclusion later in the process. The portion of the waste which does not qualify for the Bevill exclusion is within the scope of the consent decree.

The Agency has previously evaluated the Bevill status of waste streams at the Searles Lake facility. EPA Headquarters issued a Bevill opinion on February 14, 1992 at the request of EPA Region 9 and the California Toxic Substances Control Program (see Appendix E - hard copy only. Available in today's docket).⁵ After consideration of the information submitted by IMCC in its inorganic listing RCRA 3007 survey, the Agency's evaluation on the wastes covered by the Bevill exemption remains essentially the same. These conclusions are summarized briefly below.

This facility has three separate plants, Trona, West End, and Argus. Currently, only the Trona plant is producing boric acid. Therefore, the Trona plant is the only plant at IMCC subject to this listing determination. The Bevill discussion for this listing is also limited to determining the Bevill status of wastes at the Trona plant. EPA's February 14, 1992 memo noted that mineral processing begins at the liquid-liquid extraction (LLX2) step in the Trona plant where sulfuric acid is added to the loaded extractant to produce sodium sulfate and boric acid. Wastes generated before this step, including partially depleted brine, are beneficiation wastes and retain their Bevill exclusion. All wastes generated after the beginning of mineral processing are non-exempt solid wastes. Therefore, all of the wastes at this facility which are generated from the LLX2 step to the end of the process are all non-exempt solid wastes.

Based on information submitted by IMCC in their response to the RCRA 3007 survey, it is apparent that non-exempt solid wastes are mixed with exempt solid wastes at this facility. The previously issued 1992 and 1993 Bevill opinions for this facility did not identify that such mixing was occurring. As noted in the February 1992 memo, partially depleted brine is a Bevill exempt solid waste since it is generated from extraction/beneficiation. Solid wastes from the extraction/beneficiation of ores and mineral are Bevill exempt solid wastes (see 51 FR 24496, July 3, 1986, and 54 FR 36592, September 1, 1989). The partially depleted brine is pumped through WEMCO flotation cells and the brine is then pumped through a neutralization unit where

⁵The Agency re-evaluated information provided, and issued a second Bevill opinion on June 30, 1993 (Appendix E) that confirmed the findings of the earlier opinion. However it also clarified that oils from the Argus plant waste oil storage tank, the Trona plant oil skimmer, and the Trona plant oil skimmer waste oil storage tank are not, nor have ever been, exempt under 40 CFR 261.4(b)(7).

the brine and a non-exempt HCl solution are mixed. As described below, the brine is commingled with additional non-exempt wastewaters generated in the process prior to being returned to the dry lake.

2.2.2 In-process Recycling

IMC Chemical generates other wastes that are either piped directly back to the production process or used for other purposes. These materials are listed in Appendix A. Because these materials are reused on-site in production units and there is no significant potential for exposure of these materials to the environment prior to reuse, we found that they present no significant threat. Note, off-specification product, when reinserted without reclamation into the process where it originated, is not a solid waste.

2.2.3 Fuel Oil from the Crud Treatment Facility

Waste Generation

This wastestream is generated at the crud treatment facility. Crud is an aqueous/organic emulsion that is generated at several points in the process: the API settler, Wemco flotation cells, the interim storage tanks, and the FSS settler. The crud emulsion is broken down into aqueous and organic components. The treatment facility separates the emulsion by a process including pH adjustment, washing, dechlorination, and distillation steps. Three residual streams are generated: kerosene and aqueous brine, which are recycled back to the process, and fuel oil.

Waste Management

The fuel oil from crud treatment is stored in an on-site covered tank and shipped to a Subtitle C permitted used oil refinery⁶. In 1998, 690 MT were generated.

Waste Characterization

This wastestream is an organic liquid with a total hydrocarbon concentration of 1,000,000 mg/kg.

2.2.4 Miscellaneous Wastewaters

Waste Generation

Miscellaneous wastewaters generated by IMC Chemicals Inc. consist of the following wastewaters:

- C *Scrubber water.* One of the final processing steps is to remove any remaining moisture from the boric acid crystals in a gas-fired rotary dryer. The air leaving the dryer is sent to a scrubber generating scrubber water.
- C *Cooling tower blowdown.* The cooling tower provides process cooling to the crystallizer

⁶ Phone log of discussions with Demenno Kerdoon Refining. July 12, 2000. Available in docket.

- and evaporation systems. Periodically, cooling tower blowdown is generated.
- C *Hydrochloric acid solution.* The extractant used to remove the boron from the brine is produced on-site. The production process generates hydrochloric vapors which are removed in a hydrochloric acid absorber generating a hydrochloric acid solution. This solution is a characteristic (D002) hazardous waste.
- C *Washwater from the carbon process.* The carbon column is washed daily generating a washwater. In addition, the loaded carbon is removed from the carbon column and sent through a two-stage wash process to restore the carbon. This generates two additional wash waters.
- *Washwater.* Brackish water is used for equipment and facility washing generating this washwater.
- C *Mixed sulfates slurry.* The mixed sulfate solids from the #1 centrifuge are mixed with water, generating a mixed sulfates slurry.

Waste Management and Characterization

These wastewaters are combined with the Bevill-exempt partially depleted brine (see Section 2.2.1). All aqueous liquid wastestreams are sent to the Trona skimmer, where they are combined with the Bevill-exempt partially depleted brine. The characteristic hydrochloric acid waste stream is mixed into the pipeline carrying the Bevill-exempt partially depleted brine to the Trona skimmer. The resultant mixture is not characteristic. The Bevill-exempt brine goes from a pH of 9.2 prior to mixing to a pH of 8.2, post-mixing. The Bevill-exempt partially depleted brine constitutes 96 percent of the liquid generated by the plant. The Trona skimmer acts as a settling pond, promoting phase separation of the remaining organic materials in the wastewaters. An underflow weir with a vacuum collection device removes the collected organics which are then stored in a covered tank prior to shipment off-site. The Trona skimmer is also covered and has a double liner. Liquid from the storage tank is returned to the Trona skimmer. The liquid in the Trona skimmer is returned to Searles Dry Lake via percolation ponds as required by the facility's Bureau of Land Management permit. **Table 2.1** presents the individual waste volumes for each of the sources identified above. In addition, the reported constituents for each individual waste are shown.

Table 2.1 Volume and Characterization for Miscellaneous Wastewaters

Waste	1998 Volume (MT/yr)	Reported Constituents
Scrubber water	15,032	Sodium sulfate - 717 mg/kg Sodium chloride - 162 mg/kg Boric acid - 1000 mg/kg
Cooling tower blowdown	100,000*	NR
Weak hydrochloric acid solution	240	Hydrochloric acid - 176,000 mg/kg
Washwater from the carbon process		
Carbon column water	1,695	Fuel hydrocarbons - 136 mg/kg Formaldehyde - 885 mg/kg

Waste	1998 Volume (MT/yr)	Reported Constituents
Washwater from first carbon wash	1,000	Hydrocarbons Formaldehyde
Washwater from final carbon wash	313	NR
Washwater	9,940	NR
Mixed sulfates slurry	65,550	Water - 592,500 mg/kg Sodium sulfate - 215,000 mg/kg Potassium sulfate - 168,500 mg/kg Sodium chloride - 4,000 mg/kg Boric acid - 20,000 mg/kg
Total	194,040	

NR - not reported in RCRA §3007 questionnaire

* - estimate of cooling tower blowdown

Supporting Data

IMCC is located in California's Mojave Desert. The environment is arid with 4 inches of precipitation annually⁷. The groundwater under the facility has total dissolved solids (TDS) levels as high as 450,000 ppm⁸. The surrounding communities have drinking water piped in Indian Wells which is 25 miles away⁹.

2.2.5 Organics from the Trona Skimmer

Waste Generation

The commingled Bevill-exempt partially depleted brine and the miscellaneous wastewaters discussed in Section 2.2.4 are sent to the Trona skimmer for removal of organics. The Trona skimmer acts as a settling pond promoting phase separation of any remaining organic materials in the brine. An underflow weir with a vacuum collection device removes the collected organics. The organics come from the added extractant, as well as naturally occurring organics found in the brine.

Waste Management

This wastestream is stored in an on-site covered tank prior to being shipped off-site to a Subtitle C

⁷ <http://www.worldclimate.com/cgi-bin/data.pl?ref=N35W117+2200+049035C>

⁸ California Regional Water Quality Control Board permit, board order 6-91-910.

⁹ Phone log - August 20, 1999 call with California Regional Water Quality Control Board, Lahontan Region regarding the IMCC facility and the U.S. Borax facility. Available in docket.

permitted blender and subsequently burned for energy recovery in cement kilns¹⁰. In 1998, 10 MT were generated.

Waste Characterization

IMC Chemicals Inc. reported that the waste could contain chlorinated hydrocarbons but they did not report any concentrations for that constituent. The facility also reported a California-only hazardous waste code CA343 (combustible liquid) for the waste but did not report any federal characteristic codes.

2.2.6 Sludges from Containment Areas

Waste Generation

Sludges are generated from containment areas around the liquid-liquid extraction process (loading and stripping process), the API settler, and Wemco flotation cells. The sludges are generated intermittently and in highly variable quantities.

Waste Management

This wastestream is shoveled into drums by hand and then transferred to 20-cubic yard roll-offs. To make the sludge more manageable, clean soil is mixed in. This wastestream is commingled with other similar soil and debris wastes and shipped off-site to a Subtitle C landfill. In 1998, approximately 20 MT were generated.

Waste Characterization

This wastestream is a soil contaminated with petroleum hydrocarbons that is a non-RCRA hazardous waste. IMC Chemicals Inc. classifies the wastes as a California-only hazardous waste, petroleum contaminated soils (CA611). They did not report any federal waste codes for this waste.

2.2.7 Spent Activated Carbon

Waste Generation

Once a week, carbon loaded with organic substances is withdrawn from the carbon column into the carbon-cleaning system. It is washed and treated through burning before being replaced in the carbon column.

¹⁰ Phone log - Pacific Resources Recovery. July 12, 2000. Available in docket.

Waste Management

This waste is regenerated in the on-site carbon regeneration furnace. In 1998, 43 MT were generated.

Waste Characterization

The facility did not provide any characterization data for this waste other than it is a solid. The carbon filtration process occurs later in the process after much of the organic additives have settled out of the borate liquor. In addition, constituents that are filtered out using carbon adsorption should be combustible. The State of California's permit for the carbon regeneration unit requires annual emission reporting¹¹. The emissions data can be found in **Appendix B**.

3. U.S. BORAX

U.S. Borax mines sodium borate kernite ore to produce boric acid through a process of dissolution, classification, thickening, filtration and crystallization. **Figure 3.1** shows the U.S. Borax process flow diagram for the production of boric acid utilizing the kernite ore process.

3.1 DESCRIPTION OF MANUFACTURING PROCESS

Extraction, Crushing and Sizing

Kernite ore consisting of various boron compounds (borate values), clays, sands, and other insolubles is extracted from the on-site mine, crushed and sized.

Dissolution

The ore is transported to a dissolving/leaching unit where the ore is mixed with mother liquor. The mother liquor dissolves or leaches the borate from clays, sand and other insolubles that make up the ore. The resulting ore slurry is conveyed to classifiers for removal of coarse insolubles. The dissolution/leaching step generates ore dust and vapor waste streams that are captured in a scrubber. A liquid waste stream is bled from the scrubber and sent to the tailings tank.

Classification (Gravity Separation)

The slurry is sent through a series of rake classifiers which physically separate the clay, sand and other coarse insolubles (gangue) from the slurry. The remaining crude strong liquor drains from the gangue in the classifiers and is sent to a settler. This step generates gangue solids and liquids and fine ore insolubles (tailings).

Thickening (Gravity Concentration)

¹¹ Phone log. Mojave Air District Office regarding the IMC Chemicals Inc. plant in Trona California. July 11, 2000. Available in docket.

The crude strong liquor from the classifiers is then transferred to settlers and washers to further separate out ore solids. In the settlers, the fine insolubles settle by gravity to the bottom of the unit. The material at the bottom (i.e. underflow) of the unit is sent to washers and the remaining crude strong liquor is sent to filters. The underflow is diluted with mother liquor and further settled. The underflow from the washer is discharged to the tailings tank. This step generates a continuous underflow consisting of fine ore solids and liquid (tailings) from the settlers and washers.

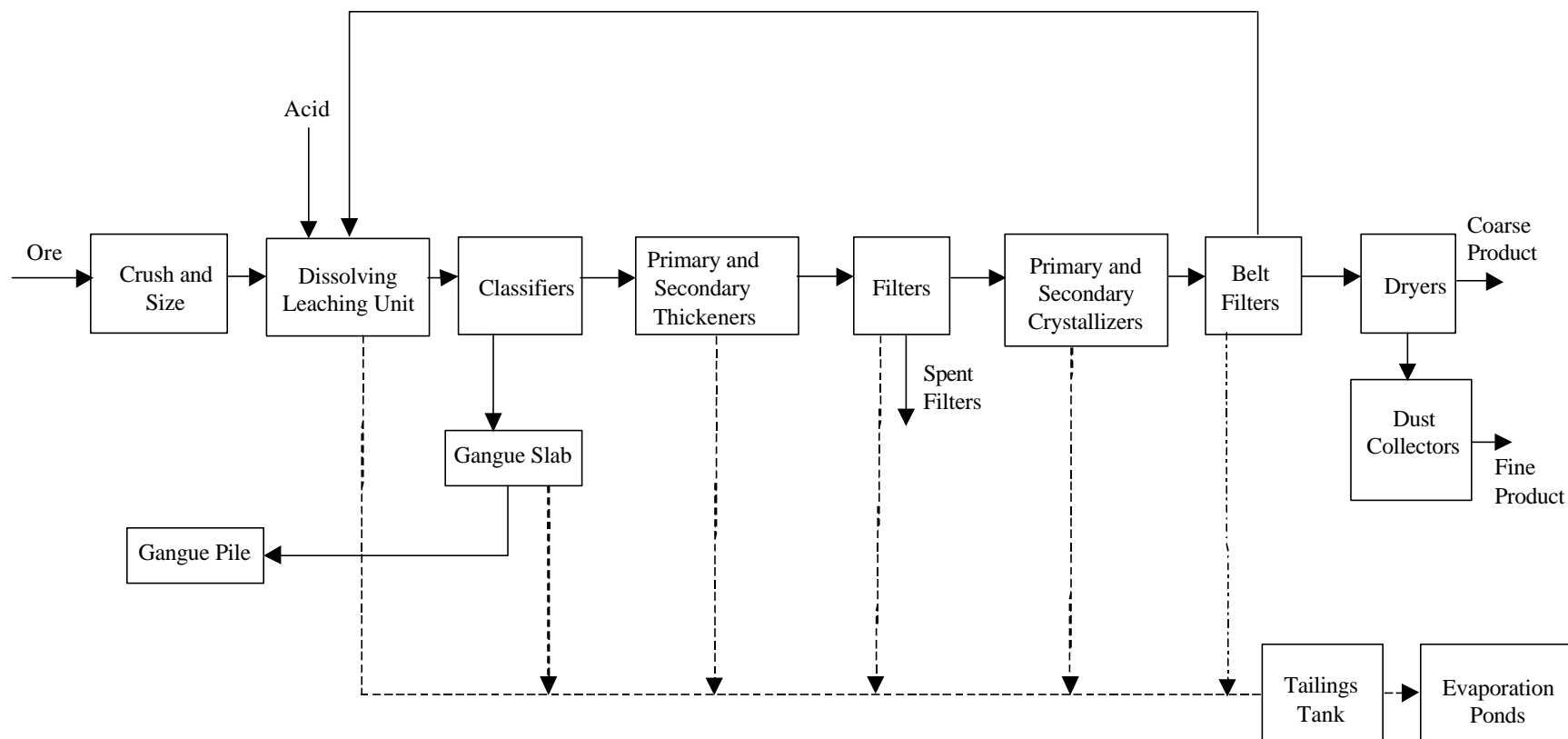
Filtration

The crude strong liquor is filtered to remove any trace of insoluble ore material. This step generates filter wastes, consisting of filter aid, spent filters, and filter rinse wastewater.

Crystallization

The filtered crude strong liquor is fed to the crystallizer to form boric acid crystals. Condensers in the crystallizer cool the filtered strong liquor by circulating water from a nearby cooling tower. Water vapor containing impurities circulates back to the cooling tower. A bleed stream continuously discharges from the cooling tower to remove carryover impurities. The crystals are separated from the residual liquor through filtration and are washed. Most of the filtrate is reused as mother liquor. A small bleed stream is also generated during the filtration and washing step. The crystals are then dried and packaged for customers.

Figure 3.1 U.S. Borax Process Flow Diagram for Boric Acid



3.2 WASTE GENERATION AND MANAGEMENT

Appendix A presents a complete summary of the wastestreams generated and their management by facility. The following sections present a detailed discussion of the wastestreams generated at U.S. Borax including each wastestream's generation, management, characterization and the results of initial screening analysis.

3.2.1 Bevill Claims

U.S. Borax made beneficiation exemption claims under the Bevill amendments for the tailings and gangue wastes. Because the Agency is not proposing to list these wastes, the facility's Bevill exemption claims were not reviewed for the purposes of this listing determination.

3.2.2 In-process Recycling

U.S. Borax generates off-spec product that is reused in the production process. The off-spec product is removed from the dryers on an ongoing basis. Additional off-spec product is removed from the dust collectors whenever they undergo periodic maintenance. The off-spec product is collected in off-spec product hoppers and returned to the secondary crusher for rerefining. Because the material is reused on-site in production units in ways that present low potential for release, and because we evaluated process waste generated after the secondary material is reinserted into the process, we do not believe that the off-specification product presents significant risks. Note that, when facilities process off-specification product by reinserting the off-specification product back into the process where it originated, without reclamation, the off-specification product would not be a solid waste.

3.2.3 Tailings

Waste Generation

Tailings include the process wastewaters and fine insolubles boric acid production. These wastestreams are generated throughout the process as clay, sand and other coarse insolubles are removed from the ore. The wastewaters include drainage from the gangue, process wastewaters, underflow from the thickener, and filter aid.

Waste Management

These wastestreams are commingled and managed in a on-site tank and then pumped to evaporation ponds (surface impoundments). Three evaporation ponds are currently in use. They were brought into service in August 1998. The ponds are triple lined. There are two HDPE liners with a leachate monitoring and collection system in between and a clay liner with a leachate collection system between it and the second HDPE liner. In addition there is groundwater monitoring outside the clay liner¹². The capacity limit of the tailings ponds in the California

¹² California Regional Water Quality Control Board, Lahontan Region permit for U.S. Borax in Boron, California. Board order number 6-93-17A3.

Regional Water Quality Control Board permit is 750,000 gallons a day. The facility reports that its current practice is to keep the ponds moist throughout the year for dust suppression¹³.

Waste Characterization

Analytical data reports (March 2000) submitted by U.S. Borax for the three tailing ponds can be found in **Appendix C**. These reports contain a full metals analysis. Based on data provided by the facility, three constituents were found to exceed health-based ingestion levels in the tailings: arsenic, antimony and boron. U.S. Borax provided additional data results for these three constituents. Table 3.1 summarizes the U.S. Borax-reported TCLP and total concentration for arsenic, antimony and boron in the tailing ponds¹⁴:

Table 3.1 U.S. Borax Tailings Waste Characterization Data

Date	Antimony		Arsenic		Boron
	TCLP	Total	TCLP	Total	Total
10/97				25.5 mg/kg	
7/98	0.11 mg/L	5.9 mg/kg			
2/99	0.43 mg/L	36 mg/kg	1.01 mg/L		
2000 ¹					9,600 ppm
3/2000		58 mg/kg 29 mg/kg 28 mg/kg		180 mg/kg 5.3 mg/kg 4.9 mg/kg	

¹ Average daily sampling January 2000

Supporting Data

The facility submitted two documents containing detailed information on the groundwater conditions at the site and on the potential risks associated with the air releases from the boric acid waste management units. The following documents are available in the RCRA docket for this proposal for further information:

“Summary of Boron Operations Hydrogeology, Potential Groundwater Receptors and Boric

¹³ U.S. Borax “Summary of Boron Operations Hydrogeology, Potential Groundwater Receptors and BAP Waste Management Parameters”, April 17, 2000, p.12.

¹⁴ Compiled from data submitted by U.S. Borax in the Exhibit F - U.S. Borax analytical information for BAP waste streams, Boric Acid Production Health Risk Assessment - March 2000, and in their follow responses from November 4, 1999 and February 18, 2000.

In addition, EPA spoke with the California Water Quality Control Board, Lahontan Region and the Kern County Environmental Health Department regarding the groundwater conditions near the U.S. Borax facility. Phone logs for those conversations are available in the docket.

3.2.4 Gangue

Waste Generation

This wastestream is generated in the rake classifiers. Classifiers physically separate the clay, sand and other coarse insolubles (gangue) from the ore slurry.

Waste Management

The gangue is placed on a slab to drain. The drained (but still wet) gangue is trucked to an on-site waste pile. Sodium borate gangue is also managed with the boric acid gangue in this waste pile. The drainage is collected and managed with the tailings (see Section 3.2.3). The total amount of gangue is 900,000 MT per year. The boric acid gangue represents a small portion of the total amount.

Waste Characterization

The facility reports that the gangue contains sodium sulfate which causes the gangue to set up like cement as it dries. Average annual rainfall in the Boron area is 4.3 inches per year while the evaporation rate is approximately 98.1 inches per year¹⁵. In their risk assessment (March 2000), U.S. Borax provided a summary of metals analyses for the boric acid gangue wastestream. These results can be found in **Appendix D**. Based on data provided by the facility, three constituents were found to exceed health-based ingestion levels in the gangue: arsenic, antimony and boron. U.S. Borax provided additional data results for these three constituents. Table 3.2 summarizes the U.S. Borax-reported TCLP and total concentration for arsenic, antimony and boron in the gangue¹⁶:

Table 3.2 U.S. Borax Boric Acid Gangue Waste Characterization Data

¹⁵ U.S. Borax “Summary of Boron Operations Hydrogeology, Potential Groundwater Receptors and BAP Waste Management Parameters”, April 17, 2000, p.3.

¹⁶Compiled from data submitted by U.S. Borax in the Exhibit F - U.S. Borax analytical information for BAP waste streams, Boric Acid Production Health Risk Assessment - March 2000, and in their follow responses from November 4, 1999 and February 18, 2000.

Date	Antimony		Arsenic		Boron
	TCLP mg/l	Total mg/kg	TCLP mg/l	Total mg/kg	Total mg/kg
10/97				78 mg/kg	
7/98	0.23	36			
12/98			0.02355	25.2	
2/99	0.186	84	0.113		
2000 ¹					25,000 ppm

¹ Average daily sampling January 2000

As part of the decision process, EPA looked at the potential for risk from air exposures to the three constituents determined to be above health-based ingestion levels in the gangue. The Agency conducted a screening analysis for arsenic by comparing numbers from EPA's Air Characteristic Study to the U.S. Borax gangue¹⁷. The Study evaluated different waste management and receptor scenarios to determine waste concentrations that would remain below a specific target risk. Using the waste pile scenario at a receptor distance of 150 meters, the study showed that arsenic levels of 6,000 ppm did not cause exceedences of the target risk levels. Comparing the arsenic levels from Table 3.2 and the distance to the closest receptor (2 miles), the Agency concluded that the levels of arsenic found in the gangue would not result in an unacceptable level of risk.

The Agency was not able to make a direct comparison to Air Characteristic numbers for antimony and boron because these two compounds were not evaluated under the Air Characteristic Study. Therefore, the Agency made a comparison between the ratios of waste concentration to health based ingestion levels for arsenic, antimony and boron. Table 3.3 shows the results of this comparison:

Table 3.3 Comparison of Waste Concentration in U.S. Borax Gangue to Health-Based Ingestion Levels

Constituent	Health-Based Ingestion level mg/l	Waste Concentration mg/kg	Ratio of Health-Based Ingestion Level to Waste Concentration
Arsenic	5	78	15
Antimony	32	84	2.5

¹⁷ EPA's Air Characteristic Study (530-R-99-019b, Aug 1999, Table 4-3)

Boron	7,200	25,000	3
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Supporting Data

The facility submitted two documents containing detailed information on the groundwater conditions at the site and on the potential risks associated with the air releases from the boric acid waste management units. The following documents are available in the RCRA docket for this proposal for further information:

“Summary of Boron Operations Hydrogeology, Potential Groundwater Receptors and Boric Acid Production Waste Management Parameters” April 17, 2000

“Boric Acid Production Health Risk Assessment” March 2000

3.2.5 Spent Filters

Waste Generation

This wastestream is generated periodically when the filters from the first filtration step are replaced. The filtration step filters the crude strong liquor to ensure the removal of any insoluble ore material before the crude strong liquor is crystallized.

Waste Management

This wastestream is stored in a solid waste bin and then managed in an on-site industrial Subtitle D landfill permitted by the Regional Waste Quality Control Board, the California Integrated Waste Management Board and the County of Kern. In 1998, 3 MT were generated. The facility reports that they apply daily cover to the landfill¹⁸.

Waste Characterization

No residual characterization was provided in the RCRA §3007 questionnaire. The filtration step occurs in the latter part of the process so the Agency expects minimal contamination. In addition, since the filters are washed weekly, the vast majority of any contaminants filtered out at this stage would be captured by the wash process and managed with the tailings.

¹⁸ Response to EPA follow up questions on §3007 survey, U.S. Borax, Boron California. February 18, 2000.

APPENDIX A

Summary of Waste Generation and Management

Wastes Evaluated in the Rule

Wastestream	Volume (MT/yr)	Management
IMC Chemicals. Inc.		
Fuel oil from crud treatment	690	Stored in an on-site covered tank then shipped to off-site Subtitle C used oil refinery
Miscellaneous wastewaters ¹		Combined with the Bevill-exempt partially depleted brine and discharged to the Trona skimmer, organics removed, returned to Searles Dry Lake bed via percolation ponds for recharging.
Scrubber water	15,032	
Cooling tower blowdown	100,000 ²	
Weak hydrochloric acid solution	240	
Washwater from the carbon process		
Carbon column water	1,695	
Washwater from first carbon wash	1,000	
Washwater from final carbon wash	313	
Washwater	9,940	
Mixed sulfates slurry ³	65,550	
Total	194,040	
Organics from Trona Skimmer ⁴	10	Stored in an on-site covered tank shipped off-site to a Subtitle C permitted blender and subsequently burned for energy recovery in cement kilns.
Sludges from containment areas	20	Stored in drums then sent to off-site Subtitle C landfill.
Spent activated carbon	43	Washed and reclaimed in on-site carbon regeneration furnace, reused in the process.
U.S. Borax Inc.		
Tailings	up to 750,000 gallons/day	Managed in a tank then pumped to evaporation ponds/surface impoundments.
Scrubber Bleed Stream		
Scrubber Washdown		
Gangue Drainage		
Gangue Slab Washdown		
Classifier Drainage		

Wastestream	Volume (MT/yr)	Management
Tailings (continued)		
Classifier Washdown		
Secondary Thickener Drainage		
Secondary Thickener Washdown		
Primary Thickener Drainage		
Primary Thickener Washdown		
Filter Drainage		
Filter Washdown		
Primary Crystallizer Washdown		
Cooling Tower Blowdown		
Cooler Tower Drainage		
Cooling Tower Washdown		
Secondary Crystallizer Washdown		
Mother Liquor Storage Washdown		
Belt Filter Bleed Stream		
Belt Filter Drainage		
Belt Filter Washdown		
Dryer Washdown		
Gangue	<900,000 ⁵	Drained on a slab, trucked to on-site waste piles.
Spent Filters	3	Stored in solid waste bin, managed in on-site industrial Subtitle D landfill.

¹ Two other wastestreams, underflow from intermediate FS tank and underflow from 303 FS tank are included in this category. However, in 1998, 0 MT were generated.

² Estimate of cooling tower blowdown.

³ IMC Chemicals also reported on #1 centrifuge solids, mixed sulfates, prior to mixing with water (32,775 MT).

⁴ IMC Chemicals also reported on the organics from the skimmer (50 MT) prior to settling in skimmer organic tank.

⁵ The boric acid coarse gangue is co-mingled with gangue from the other production process at the facility which is outside the scope of the consent decree. The boric acid gangue represents only a minor proportion of the total 900,000 tons of gangue typically deposited annually on the waste piles. Source: California Regional Water Quality Control Board permit, board order 6-93-17.

Bevill Exempt Wastes¹⁹

Wastestream	Volume (MT/yr)
IMC Chemicals, Inc.	
Partially Depleted Brine from Loading Settler	4,600,000
Partially Depleted Brine from API	4,604,400
Partially Depleted Brine from Wemcos	4,602,096
Partially Depleted Brine from Neutralization	4,602,336
Partially Depleted Brine from Skimmer ¹	5,942,876

The partially depleted brine from the loading section is Bevill exempt and outside the scope of the consent decree as discussed in Section 2.4.1. IMC Chemical Inc. reported a new RIN for this waste as it went through intermediate steps in the process. These wastes as those listed under the partially depleted brine from the loading settler.

¹ The partially depleted brine from skimmer is a mixture of the Bevill exempt waste and the miscellaneous wastewaters discussed in Section 2.2.4. The volume includes wastewaters from other non-Boric Acid processes at the plant that are outside the scope of the consent decree.

¹⁹ In the context of this rulemaking, EPA has declined to review the Bevill-excluded status of the wastes generated by U.S. Borax.

In-Process Recycling

Wastestream	Volume (MT/yr)
IMC Chemicals, Inc.	
Crud from API	2,582
Water from Crud Treatment	4,669
Recycled Kerosene from Crud Treatment	339
P20 Scrubber Liquid	13
Surface Disposal from Top of Interim Tank	22
Surface Disposal from Top of 303 Tank	22
Off-Spec Product	7,200
Second Effect Cond	76
Crud from FSS Settler	594
Bleed from BE Tank	727
Washed Carbon	NR
Carbon from Furnace	43
Organics from Wemco	NR
Liquid from Skimmer Tank	40
U.S. Borax	
Dryer Off-Spec Product	NR
Dust Collector Off-Spec Product	NR

NR Not reported in facility's RCRA §3007 questionnaire

These wastestreams are discussed in Sections 2.2.2 and 3.2.2.

Additional Reported Materials

Material	Volume (MT/yr)
IMC Chemicals, Inc.	
LLX Kerosene Vapors	24

The LLX process and WEMCO flotation cells produce kerosene vapors. The vapors are piped to on-site argus boilers. RCRA §1004(27) excludes from the definition of solid waste all gases that are not containerized or condensed. Because these vapors are not containerized or condensed, they are not a solid waste and therefore cannot be a hazardous waste.

APPENDIX B

IMC Chemicals Inc. Trona Carbon Regeneration Furnace Emissions Data

Pollutant	Emissions				
	1990	1991	1993	1994/95	1996
Criteria (Tons per year)					
Carbon monoxide	0.5	1.61	1.06	1.02	1.047
Oxides of Nitrogen	0	0.123	0.083	0.08	0.082
Particulate matter	0.2	619	0.35	0.38	0.39
Sulfur dioxide	0.1	0.5	0.3	0.3	0.287
Total Organic Gas	7.4	0	0.007	0.0074	0.0076
Toxic Substances (pounds per year) (reporting not required until 1996)					
Aluminum					2.31
Barium					1.71
Benzene					4.21
Cadmium					0.011
Copper					0.27
Dioxins, total without individual isomers reported (PCDDs)					0.0000142
Formaldehyde					1.53
Lead compounds (inorganic)					0.275
Manganese					0.056
Methylene chloride (Dichloromethane)					0.198
Naphthalene					0.384
PAHs, total, with individual components also reported					0.442
Perchloroethylene (tetrachloroethene)					0.00159
Toluene					1.93
Vinyl chloride					0.736
Xylenes (mixed)					0.505

APPENDIX C

Analytical Data Report for U.S. Borax Tailing Ponds

Sample Description: Tailings Pond #1

Date Sample: 03/24/2000

Sample Type: Liquid

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date	Analysis Date
Aluminum (Al)	EPA 200.7	ND	mg/L	0.1	10	1.0	3/28/2000	3/28/2000
Antimony (Sb)	EPA 200.8	58	mg/L	0.2	100	20	3/28/2000	3/28/2000
Arsenic (As)	EPA 200.8	180	mg/L	0.02	100	2.00	3/28/2000	3/28/2000
Barium (Ba)	EPA 200.8	1.8	mg/L	0.1	5	0.5	3/28/2000	3/28/2000
Beryllium (Be)	EPA 200.8	ND	mg/L	0.02	5	0.10	3/28/2000	3/28/2000
Cadmium (Cd)	EPA 200.8	ND	mg/L	0.02	5	0.10	3/28/2000	3/28/2000
Calcium (Ca)	EPA 200.7	210	mg/L	0.2	10	2.0	3/28/2000	3/28/2000
Chromium - Total (Cr)	EPA 200.8	ND	mg/L	0.1	5	0.5	3/28/2000	3/28/2000
Cobalt (Co)	EPA 200.8	ND	mg/L	0.1	5	0.5	3/28/2000	3/28/2000
Copper (Cu)	EPA 200.8	0.70	mg/L	0.1	5	0.5	3/28/2000	3/28/2000
Iron (Fe)	EPA 200.7	19	mg/L	0.1	10	1.0	3/28/2000	3/28/2000
Lead (Pb)	EPA 200.8	ND	mg/L	0.05	5	0.25	3/28/2000	3/28/2000
Magnesium (Mg)	EPA 200.7	480	mg/L	0.2	10	2.0	3/28/2000	3/28/2000
Manganese (Mn)	EPA 200.7	9.4	mg/L	0.02	10	0.20	3/28/2000	3/28/2000
Mercury (Hg)	EPA 200.8	ND	mg/L	0.004	5	0.020	3/28/2000	3/28/2000
Molybdenum (Mo)	EPA 200.8	4.5	mg/L	0.1	5	0.5	3/28/2000	3/28/2000
Nickel (Ni)	EPA 200.8	ND	mg/L	0.1	5	0.5	3/28/2000	3/28/2000
Potassium (K)	EPA 200.7	380	mg/L	4	10	40	3/28/2000	3/28/2000
Selenium (Se) - Total	EPA 200.8	ND	mg/L	0.02	5	0.10	3/28/2000	3/28/2000
Silver (Ag)	EPA 200.8	ND	mg/L	0.2	5	1.0	3/28/2000	3/28/2000
Sodium (Na)	EPA 200.7	29000	mg/L	2	100	200	3/28/2000	3/28/2000
Thallium (Tl)	EPA 200.8	ND	mg/L	0.2	5	1.0	3/28/2000	3/28/2000
Vanadium (V)	EPA 200.7	0.80	mg/L	0.02	10	0.20	3/28/2000	3/28/2000
Zinc (Zn)	EPA 200.7	ND	mg/L	0.1	10	1.0	3/28/2000	3/28/2000

PQL: Practical quantitation limit

ND: none detected at DLR

DLR: detection limit for reporting; PQL x Dilution mg/L: milligrams/liter (ppm)

Sample Description: Tailings Pond #2

Date Sample: 03/24/2000

Sample Type: Liquid

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date	Analysis Date
Aluminum (Al)	EPA 200.7	4.0	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
Antimony (Sb)	EPA 200.8	29	mg/L	0.2	5	1.0	3/28/2000	3/29/2000
Arsenic (As)	EPA 200.8	5.3	mg/L	0.02	5	0.10	3/28/2000	3/29/2000
Barium (Ba)	EPA 200.8	1.0	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
Beryllium (Be)	EPA 200.8	ND	mg/L	0.02	5	0.10	3/28/2000	3/29/2000
Cadmium (Cd)	EPA 200.8	ND	mg/L	0.02	5	0.10	3/28/2000	3/29/2000
Calcium (Ca)	EPA 200.7	840	mg/L	0.2	10	2.0	3/28/2000	3/29/2000
Chromium - Total (Cr)	EPA 200.8	ND	mg/L	0.1	5	0.5	3/28/2000	3/29/2000
Cobalt (Co)	EPA 200.8	ND	mg/L	0.1	5	0.5	3/28/2000	3/29/2000
Copper (Cu)	EPA 200.8	ND	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
Iron (Fe)	EPA 200.7	170	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
Lead (Pb)	EPA 200.8	ND	mg/L	0.05	5	0.25	3/28/2000	3/29/2000
Magnesium (Mg)	EPA 200.7	2900	mg/L	0.2	10	2.0	3/28/2000	3/29/2000
Manganese (Mn)	EPA 200.7	91	mg/L	0.02	10	0.20	3/28/2000	3/29/2000
Mercury (Hg)	EPA 200.8	ND	mg/L	0.004	5	0.020	3/28/2000	3/29/2000
Molybdenum (Mo)	EPA 200.8	2.4	mg/L	0.1	5	0.5	3/28/2000	3/29/2000
Nickel (Ni)	EPA 200.8	ND	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
Potassium (K)	EPA 200.7	440	mg/L	4	10	40	3/28/2000	3/29/2000
Selenium (Se) - Total	EPA 200.8	ND	mg/L	0.02	5	0.10	3/28/2000	3/29/2000
Silver (Ag)	EPA 200.8	ND	mg/L	0.2	5	0.10	3/28/2000	3/29/2000
Sodium (Na)	EPA 200.7	32000	mg/L	2	200	400	3/28/2000	3/29/2000
Thallium (Tl)	EPA 200.8	ND	mg/L	0.2	5	1.0	3/28/2000	3/29/2000
Vanadium (V)	EPA 200.7	ND	mg/L	0.02	10	0.20	3/28/2000	3/29/2000
Zinc (Zn)	EPA 200.7	3.0	mg/L	0.1	10	1.0	3/28/2000	3/29/2000

PQL: Practical quantitation limit

ND: none detected at DLR

DLR: Detection limit for reporting; PQL x Dilution mg/L; milligrams/liter (ppm)

Sample Description: Tailings Pond #3

Date Sample: 03/24/2000

Sample Type: Liquid

Analyte	Method	Result	Units	PQL	Dilution	DLR	Prep Date	Analysis Date
Aluminum (Al)	EPA 200.7	3.7	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
Antimony (Sb)	EPA 200.8	28	mg/L	0.2	5	1.0	3/28/2000	3/29/2000
Arsenic (As)	EPA 200.8	4.9	mg/L	0.02	5	0.10	3/28/2000	3/29/2000
Barium (Ba)	EPA 200.8	4.0	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
Beryllium (Be)	EPA 200.8	ND	mg/L	0.02	5	0.10	3/28/2000	3/29/2000
Cadmium (Cd)	EPA 200.8	ND	mg/L	0.02	5	0.10	3/28/2000	3/29/2000
Calcium (Ca)	EPA 200.7	830	mg/L	0.2	10	2.0	3/28/2000	3/29/2000
Chromium - Total (Cr)	EPA 200.8	ND	mg/L	0.1	5	0.5	3/28/2000	3/29/2000
Cobalt (Co)	EPA 200.8	ND	mg/L	0.1	5	0.5	3/28/2000	3/29/2000
Copper (Cu)	EPA 200.8	ND	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
Iron (Fe)	EPA 200.7	160	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
lead (Pb)	EPA 200.8	ND	mg/L	0.05	5	0.25	3/28/2000	3/29/2000
Magnesium (Mg)	EPA 200.7	2800	mg/L	0.2	10	2.0	3/28/2000	3/29/2000
Manganese (Mn)	EPA 200.7	87	mg/L	0.02	10	0.20	3/28/2000	3/29/2000
Mercury (Hg)	EPA 200.8	ND	mg/L	0.004	5	0.020	3/28/2000	3/29/2000
Molybdenum (Mo)	EPA 200.8	2.2	mg/L	0.1	5	0.5	3/28/2000	3/29/2000
Nickel (Ni)	EPA 200.8	1.0	mg/L	0.1	10	1.0	3/28/2000	3/29/2000
Potassium (k)	EPA 200.7	410	mg/L	4	10	40	3/28/2000	3/29/2000
Selenium (Se) - Total	EPA 200.8	ND	mg/L	0.02	5	0.10	3/28/2000	3/29/2000
Silver (Ag)	EPA 200.8	ND	mg/L	0.2	5	0.10	3/28/2000	3/29/2000
Sodium (Na)	EPA 200.7	32000	mg/L	2	200	400	3/28/2000	3/29/2000
Thallium (Tl)	EPA 200.8	ND	mg/L	0.2	5	1.0	3/28/2000	3/29/2000
Vanadium (V)	EPA 200.7	ND	mg/L	0.02	10	0.20	3/28/2000	3/29/2000
Zinc (Zn)	EPA 200.7	3.0	mg/L	0.1	10	1.0	3/28/2000	3/29/2000

PQL: Practical quantitation limit

ND: none detected at DLR

DLR: detection limit for reporting; PQL x Dilution

mg/L: milligrams/liter (ppm)

APPENDIX D

Analytical Data Report for U.S. Borax Gangue

Summary of Constituents of Interest Identified in BAP Plant Gangue²⁰

Air Toxic	Concentration (mg/kg)	Source of Data
Arsenic	78	Site-specific gangue analysis (10/97)
Beryllium	<1.3	Estimated from kernite ore analysis (1987)
Cadmium	0.04	Site-specific gangue analysis (10/97)
Chromium VI	4.6	Site-specific gangue analysis (10/97)
Copper	16.9	Estimated from kernite ore analysis (1987)
Lead	2.94	Site-specific gangue analysis (10/97)
Manganese	<0.060	Estimated from kernite ore analysis (1987)
Mercury	0.09	Site-specific gangue analysis (10/97)
Nickel	<130	Estimated from kernite ore analysis (1987)
Barium	54	Site-specific gangue analysis (10/97)
Cobalt	<130	Estimated from kernite ore analysis (1987)
Vanadium	<130	Estimated from kernite ore analysis (1987)
Boron	25,000	Average gangue concentration (1/2000)
Antimony	84	Site-specific gangue analysis (10/97)

²⁰ Excerpt from U.S. Borax submitted Boric Acid Production Health Risk Assessment, March 2000, p 13. Available in docket.

APPENDIX E

EPA Memos on the Regulatory Status of Wastes from Searles Lake Operations (Hard copy only)

APPENDIX F

List of Changes to Background Document

Changes to Background Document

1. Page 13-14, *Dissolution/Leaching* description. Changed language to clarify process step.
2. Page 14. Added “(*Gravity Separation*)” to *Classification* heading.
3. Page 15. Flow diagram substituted with revised version.
4. Page 16, Section 3.2.2, 2nd sentence. Changed timeframe for off-spec product removal.
5. Page 16, Section 3.2.3, 1st sentence. Correction to tailings description.
6. Appendix A, page 4. Added qualifying statement regarding Bevill determination at U.S. Borax.